

Forum Brief

ATE Centers and Community Colleges: Increasing Underrepresented Minorities Participating in STEM Fields

A Forum — November 21, 2008

Overview

This was the last in a series of forums showcasing the work of the Advanced Technological Education (ATE) program, created by the U.S. Congress in 1992 in an effort to boost the nation's supply of highly skilled technicians in math-, science-, and engineering-intensive industries. Funded and overseen by the National Science Foundation, ATE's thirty centers and numerous programs—located in every part of the country—coordinate efforts among high school and community college educators, business leaders, and government officials to recruit and train workers for rewarding careers in growing sectors of the economy, such as biotechnology, chemical technology, civil and construction technology, and electronics.

This forum featured programs that have made it a priority to reach out to students from populations that long have been underrepresented in technology professions as well as higher education.

Housed at Cabrillo College—a community college located near Monterrey, California—the Digital Bridge Academy is attended mainly by low-income, Hispanic adults hoping to reconnect to the educational system and earn a postsecondary degree. Many speak English as a second language, are the first in their family to attend college, and/or have attempted but not been successful in college previously.

And **DC Bio Tech**—a career academy located on the campuses of Washington, DC's McKinley Tech and Ballou high schools—introduces students to the region's growing biotech industry through core classes and partnerships with local businesses. Directed jointly by the District of Columbia Public Schools, the Carnegie Institution of Washington, DC, and nearby Montgomery (MD) College, the program stresses both rigorous instruction in biology, chemistry, and math and ongoing professional development for teachers.

Diego Navarro, **Program Director of the Digital Bridge Academy (DBA)**, began by recounting his own experience as a student at Pasadena City College, where he started his undergraduate studies. While he succeeded academically and went on for bachelor's and master's degrees, he recalls how disconnected the curriculum seemed from his own life experiences, and he remains convinced that many community colleges are failing to make their programs relevant to their students' needs.

Nationally, students aren't faring well at two-year colleges, Navarro noted, citing data showing that 67% drop out while still at a remedial-level classes; never reaching eligibility to transfer into the regular undergraduate curriculum. In other words, many students get so bogged down in remedial classes that they never even have the chance to get started on an degree-awarding course of study.

Typically, Navarro said, those remedial classes offer the very same kind of incremental, sequential instruction that failed to engage students when they were in high school. Far more rare, and far more effective, are programs that accelerate instruction for under-prepared students, and that tap into their interests and real-world experiences, which often have provided them with knowledge and skills that go way beyond their grasp of basic math and science concepts.

Before launching Digital Bridge, Navarro and others spent a year and a half reviewing research and conducting interviews of prospective students, in order to ensure that the program would meet their needs. Their design process also considered how to ensure the program would be replicable on a large scale. Early on, Navarro said, it became clear that students would need not just academic help, but also assistance in overcoming serious affective and behavioral issues. In addition, it became evident that students needed explicit instruction about the norms and expectations of college life, such as how to maintain positive relationships with faculty, how to manage time pressures, and where to go for support.

Several years later, the program is posting impressive results, suggesting that it has found a good mix of academic and personal support, and that it can be replicated. A recent evaluation revealed that 75% of DBA students successfully completed two years of college-level work, as opposed to 32% of comparable students enrolled in the regular curriculum. Further, an evaluation by the National Science Foundation showed that DBA students had double the retention and persistence rates of comparable students, and their grade point averages were twice as high.

Since its full inception in 2003, the program has grown quickly, enrolling 423 full-time students in its first five years but expecting to enroll roughly 600 for the coming year alone. Demand for professional development has expanded quickly, too, with 200 faculty members signed up for training sessions in the next few months.

The core of DBA's curriculum is a one-semester introductory class and a second-semester seminar, both of which provide accelerated instruction in math and science, along with group team-building, individualized support, and explicit guidance in college norms and expectations. Beginning in the second semester, students also enroll in regular college math, science, and technology classes (which are designed to prepare them for a range of possible careers).

When community colleges discover that a particular student population is having trouble, they typically respond by throwing support services, such as tutoring or advising, at the problem. But, Navarro said, DBA's approach—rooted in current research on brain development and self-efficacy—has been to change the kind of *instruction* offered to students, giving them more project-based work, with an emphasis on setting and meeting challenging academic goals.

For the upcoming years, said Navarro, DBA intends to replicate its model widely, according to an ambitious but feasible growth

Presenters

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"One of the intangible benefits that's gained from AYPF trips is the ability for Republican and Democrat staff to sit down in a non-partisan arena to discuss policy issues. The field trips give staff time to get to know each other and develop friendships outside of work. It is much easier to go to conference on bills when you have spent time with the 'other side.'"

plan. If community colleges pair up to offer professional development to groups of thirty faculty members at a time, it should be possible within a few years to scale up to more than a hundred campuses across the country, each serving a thousand students.

One key policy lesson learned at DBA, Navarro concluded, is that community colleges' financial model needs to be rethought. Policymakers should create strong incentives for campuses to enroll students full-time and to provide them with accelerated instruction, backed up with rigorous professional development, rather than throwing money into discrete support services. Further, research from the Gates Foundation suggests that performance-based scholarships can be an extremely effective means of promoting degree completion.

Toby Horn, **Co Director of DC BioTech**, described the two-year-old program as an effort to help bored and disengaged high school students to develop critical academic skills and the essentials of professional behavior. Drawing on lessons learned at other ATE centers across the country, DC BioTech's core components include teacher professional development, with an emphasis on connecting classroom learning to real-world skills and workplace norms; student internships at local biotech firms; and efforts to partner with those firms in other ways.

Given the costs associated with biotech materials and facilities, DC BioTech was fortunate to have the DC Public Schools contribute textbooks and new laboratory space at McKinley Tech. In addition, funding sufficient to place twenty students per summer at workplace internships has been provided by the National Science Foundation and DCPS.

While the program is still quite new, teachers and students have already become comfortable using what are, in effect, college-level texts and professional technical manuals. Along with performing laboratory work and studying science content, students are getting rich opportunities to research and write realistic materials such as grant-applications, budgets, and procurement orders.

It has proven to be difficult, Horn explained, to schedule time for professional development, given that DC BioTech's teachers already have commitments such as staffing after-school centers, teaching GED students, and teaching summer school. However, the district's office of career and technical education is in the process of creating an advisory board for the program, and Horn is now pulling together an advisory committee made up of local employers, who are helping to identify the key tasks, lab skills, and content that their industry demands of new workers.

One of the most interesting and unexpected ways in which DC BioTech has developed, said Horn, has been its use of multi-media tools, which it borrows from McKinley Tech's Broadcasting program (one of its three career and technical tracks). Students have been developing short films, both as a means of instructing one another in course content and as a way to master it themselves. Further, such work is nicely aligned with industry standards (as codified in SCANS), which call for technology programs to include a strong emphasis on communications and public presentation.

Following school district guidelines, DC BioTech requires a series of four courses, including an introduction to biotechnology, BioTech 2, Advanced Molecular Methods, and an Applications class. Further, students complete a senior research project, in which they study their own and one another's ancestries—the program is working out plans for students to do this work with assistance from Howard University's Human Genome Center.

At present, enrollment in DC BioTech is in the low-average range for career and technical education (CTE) programs in the district. Given that local CTE administrators have been enthusiastic about BioTech from the beginning, the program expects to receive ongoing support, and it plans to continue to grow. For example, it is in the process of developing a feeder program into the biotech program at Montgomery College (Washington, DC doesn't have a community college of its own).

However, DC BioTech still contends with a number of start-up challenges. For instance, the city hasn't yet begun to provide McKinley's labs with distilled water, which is required for much of the biotechnical lab work. And while employers have proven to be willing to share advice and sponsor internships, many of them are located in the far suburbs, making for long and difficult student commutes.

As for policy recommendations, said Horn, she would advise school districts to be sure to invest in the infrastructure and professional development that such career academies require. In particular, it would be helpful to give teachers a significant amount of planning time, so that they can design laboratory projects, as well as to provide teachers with funds to defray the costs of developing their own content knowledge. Finally, while this isn't strictly a policy recommendation, she would urge employers to be patient in helping student interns to learn soft skills such as how to dress for and conduct themselves appropriately in the workplace.

Gerhard Salinger, **Program Officer at the National Science Foundation**, gave a brief overview of the ATE program, which has worked for 16 years to build bridges between community colleges and employers in science, technology, engineering, and math-related (STEM) fields, as well as to strengthen high school STEM programs.

Of those students who earn bachelors and/or masters' degrees in STEM disciplines, Salinger noted, roughly 44% get started on their undergraduate studies at a community college. Those institutions have a solid record of producing well-prepared technicians for jobs in high-demand fields, they tend to be very responsive to the changing needs of their regional industries, their programs are relatively inexpensive, and they serve very diverse student populations.

While the ATE program relies on discretionary funds, its budget has grown steadily over the years, said Salinger, and it is now expanding into new areas, such as the education of workers for the manufacturing sector and the sponsorship of long-term evaluations. New ATE centers include the National Center for Nanotechnology Applications, at Penn State (which offers students a rare opportunity for hands-on study in a field that relies on expensive, cutting-edge equipment) and the new Convergence Technology center at Collin County Community College, in Plano Texas (which is working on an exciting project with regional employers to prepare students for "green" information technology jobs).

Highlights from the Question and Answer Session

The first question, addressed to Navarro, asked how difficult it has been to integrate part-time faculty into the Digital Bridge model. The program works pretty well for itinerant, adjunct professors, Navarro replied. In fact, if the DBA is scaled up to a number of campuses in a single region, that should make it easy for faculty to put together a full-time schedule, since courses will be consistent from one college to the next. Currently, 70% of DBA faculty members are adjuncts, said Navarro, and because the program is so focused on student support, they are required to attend weekly meetings, where faculty share notes on the progress of individual students.

The second questioner asked whether STEM faculty have resisted the shift from a "sorting" model of instruction (designed more to identify high-achievers than to help all students learn) to a more hands-on, talent-development model? Navarro said that he has seen no pushback from any of the faculty that he works with. And, he notes, the pedagogy that DBA uses in its professional development is precisely the same as (and was modeled on) that which is provided to executives at large corporations—it's

respectful, hands-on, and project-based, and it has been well-received by college faculty, staff, and administrators. Added Salinger, the old "sort and sift" model of science and math instruction is quickly going out of favor not only at community colleges, but also at research universities. There's a growing recognition that the country needs a lot of well-trained graduates, not just a few superstars.

A third questioner asked what would be the speakers' top recommendations for anybody working to help teachers provide more hands-on instruction, particularly in service-learning programs. Horn said that when students get real-world exposure to the workplace (through internships and other opportunities), they begin to demand more hands-on instruction. The DC BioTech program is still young, though, she acknowledged. Students are now at the point where they're beginning to see how relevant the education is to the real world, and some patience is required while the teachers learn to adjust. Navarro said that he would give three recommendations. First, in running the DBA model, he has found that faculty need a real immersion in hands-on pedagogy, and that it takes a three-day seminar for it to really sink in. The seminar doesn't have to be residential, he adds, but it does require intensive, full day sessions, much like what typically goes on in executive training. Second, the professional development must itself be project-based. And third, faculty need to be encouraged to focus on students' strengths. For instance, the DBA puts a strong emphasis on discussions of social justice issues in the classroom, since the students' life experiences have given them PhDs in that topic. In a science-based program, that could mean assigning students to do survey research and public presentations dealing with environmental degradation in their neighborhoods, for example. When it comes to that kind of issue, students are already invested, and they already have great access to interview subjects and study sites.

The final question focused on the role of community college administrators. What can they do to better serve underrepresented student populations, particularly to increase participation in the STEM fields? Horn echoed Navarro's previous recommendation, reiterating that administrators should look to students' strengths, finding ways for the school to tap into their experience and maturity. Navarro added that administrators should expand their assessments and records to focus more broadly on students' needs. For example, his college now assesses not just students' English language, math, and reading skills but also their sense of self-efficacy and self-regulation, as well as their educational and life goals. The college has found that many students have a very limited sense of efficacy, and that those students are prone to drop out of the program unless it makes efforts to help them set concrete goals and build confidence. Added Salinger, administrators need to ask themselves whether their campuses truly are set up to serve their students. For example, many community colleges offer student tutoring and other services only from 8-5:00, even though the majority of students work during the day. A lot of progress can be made just by recognizing that kind of disconnect and adjusting accordingly.

Biographies:



Diego Navarro, is an Instructor, and serves on the Faculty Senate, at Cabrillo College a community college serving Santa Cruz County. He is the Founder and Principal Investigator for a National Science Foundation funded project, the Digital Bridge Academy (DBA), which serves under-prepared Latino students and is in the process of being replicated in community colleges in the San Francisco Bay Area serving urban African-American, Latino and Asian students. The DBA is also funded by the James Irvine, the William and Flora Hewlett, the David and Lucile Packard, and the Walter S. Johnson Foundations. Diego has been teaching at Cabrillo College since 2002 and is the lead DBA faculty member. Diego started college at Pasadena City College. He worked 32 hours a week as a computer support specialist at Bank of America to pay his way through school.

Diego began his professional career as a community organizer for the American Friends Service Committee, a Quaker humanitarian aid organization while he was in his third year in college. Diego has over twenty years experience in research and management positions in the computer industry with Hewlett Packard Labs, Apple Computer, NCR Corporation, and CEO of two start-up high-tech companies. Diego received his master's degree from Harvard University's Graduate School of Business, and holds an undergraduate degree in Information Systems from Antioch University.



Toby Horn, is Co-Director of the Carnegie Academy for Science Education (CASE), Carnegie Institution for Science (DC). Educated in NYC public schools, first college graduate in her family, with years of working as a laboratory skilled helper, Horn earned a Chemistry A.B. from Bryn Mawr College (PA) and a Ph.D. in MCD Biology from the University of Colorado, Boulder (CO). After a staff fellowship at the National Cancer Institute, she became the founding director of the Life Science and Biotechnology Laboratory at Thomas Jefferson High School for Science and Technology (Fairfax County Public Schools) in Alexandria, VA, and co-developer of one of the first high school biotechnology programs in the U.S. In 12 years, "Dr. Toby" taught biotech to more than 4,000 9th graders and hundreds of juniors and seniors, establishing both in-school senior research and outside mentorships at federal and university laboratories in the DC metropolitan area. After serving as outreach coordinator for the Fralin Biotechnology Center at Virginia Tech (Blacksburg, VA), in 2001, Horn joined CASE for the DC ACTS project, an NSF-funded partnership of Carnegie, AAAS and District of Columbia Public Schools (DCPS) to improve science education in DC secondary schools. In 2003, the DCPS Office of Career and

Technical Education asked CASE to help establish a Biotechnology Career Pathway for McKinley Technology High School (that now includes Ballou Senior High School), which evolved into DC Biotech. Horn co-authored Working with DNA and Bacteria in Pre-college Science Classrooms for the National Association of Biology Teachers and served as its Secretary-Treasurer and as 2006 President. Principal Investigator: DC Biotech: Improving Opportunities for Urban Minority Students (NSF Award#0603415)



Gerhard Salinger, is a Program Director in the Division of Research in Learning in Formal and Informal Settings (DRL) in the Directorate for Education and Human Resources (EHR) at the National Science Foundation (NSF). In this position, he recommends the funding of proposals to develop and do research on nationally disseminated instructional materials and professional development of K-12 teachers supporting educational reform in mathematics, science and technology education in K-12 classrooms. He has also been co-Lead Program Director of the Advanced Technological Education program since inception in 1993.

Prior to coming to the NSF in 1989, Salinger was a professor in the Physics Department at Rensselaer Polytechnic Institute in Troy, New York for twenty-five years and chairman of the Department for eleven years. In his research work on the low temperature properties of amorphous materials, he supervised ten students in their Ph.D. work and has about twenty-five publications including a successful, college-level textbook on thermodynamics published by Addison-Wesley.

Salinger received his B.S. in Physics from Yale University in 1956 and an M.S. and Ph.D. in physics from the University of Illinois in 1958 and 1961 respectively. Before going to Rensselaer Polytechnic Institute in 1964, he spent two years establishing a low temperature physics laboratory at the University of Sao Paulo in Brazil.

Resources:**[CCS Impact Booklet](#)**

[PPT Presentation, Diego Navarro: Increasing Underrepresented Minorities Participating in STEM Fields](#)

[The Alleviation of Poverty and the Role of the Community College](#); By Diego James Navarro, Director: Cabrillo College's Digital Bridge Academy Feb. 2008

[Digital Bridges to Community College](#): By Diego Navarro: *Community College Journal August/September 2005*

[Digital Bridge Academy](#): Education to Bridge the Digital Divid: *by Diego James Navarro, October 2008*

[Rethinking Remedial Education](#): Inside Higher Ed: Elizabeth Redden

Logistics

[Maps & Metro Rail](#)

Date: Friday, November 21, 2008

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